

High yield cranial nerves



Grzegorz Goncerz

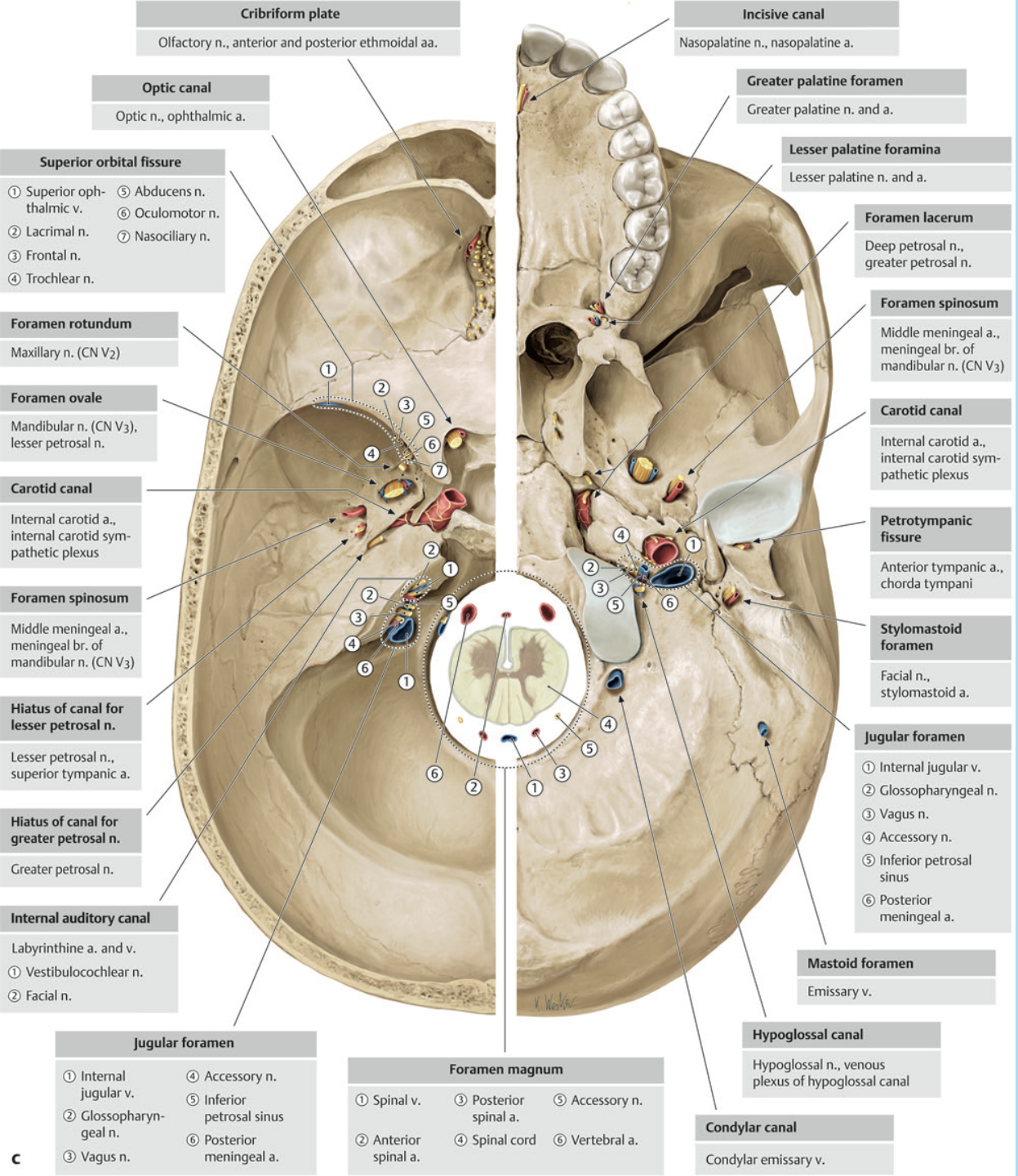
to me ▾

Dear Amalie,

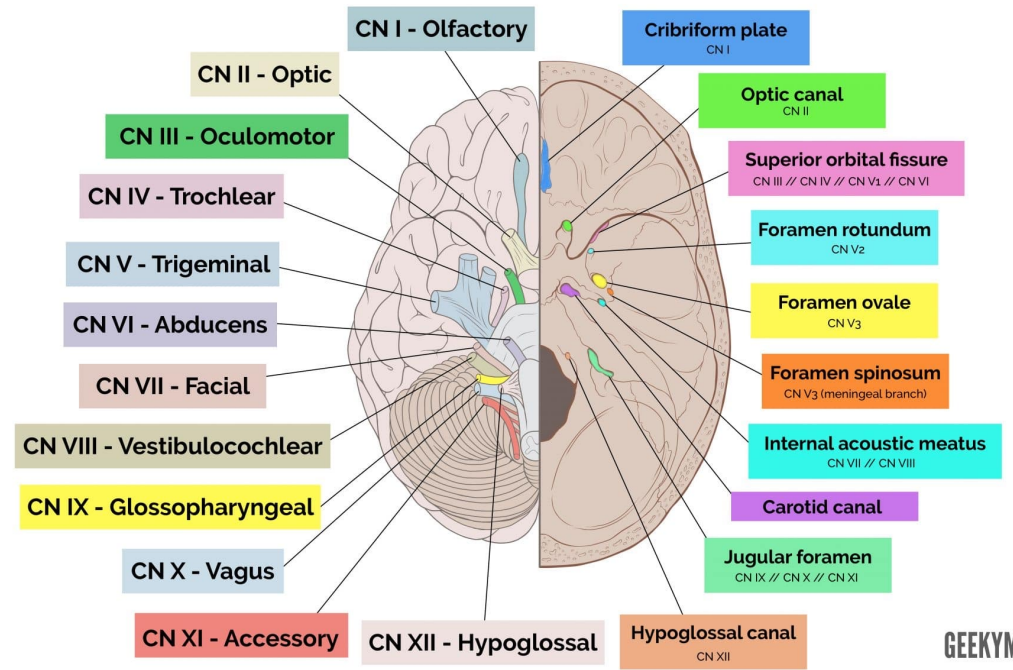
What is the most important? Simply - the cranial nerves.

Regards,

Grzegorz G.



CRANIAL NERVES AND SKULL FORAMINA



CN III - Oculomotor

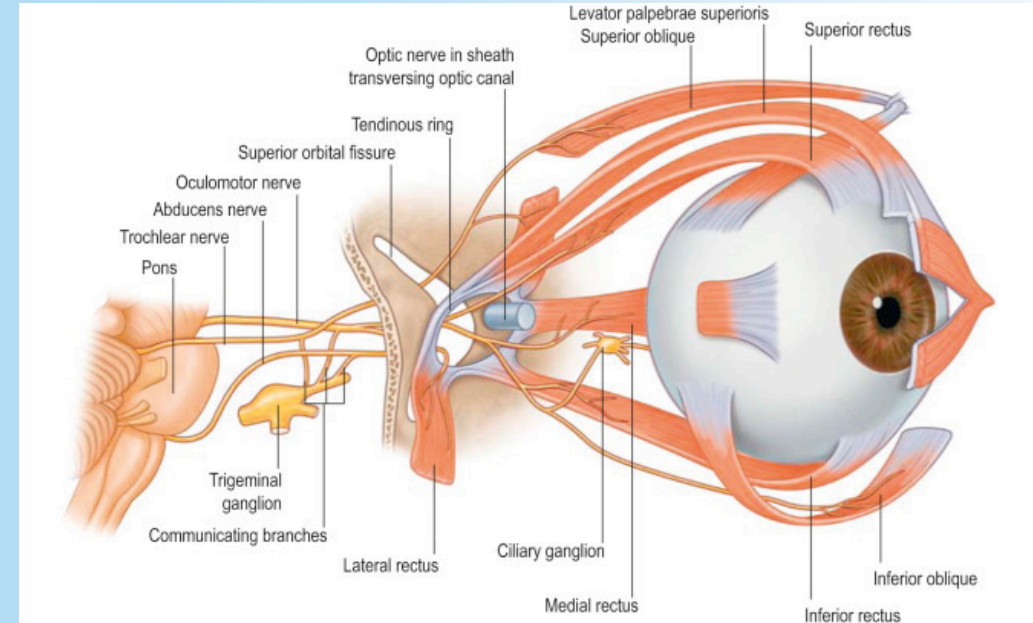
- Exits the skull through Superior Orbital Fissure (SOF) and then through the common tendinous ring

Motor

- Movement of the eye, through contraction of all the extraocular muscles except for SO_4LR_6
 - SO_4 = Superior oblique, controlled by CN 4
 - LR_6 = Lateral rectus, controlled by CN 6
- Levator palpebrae
 - Responsible for opening the eye

Parasympathetic fibers innervate

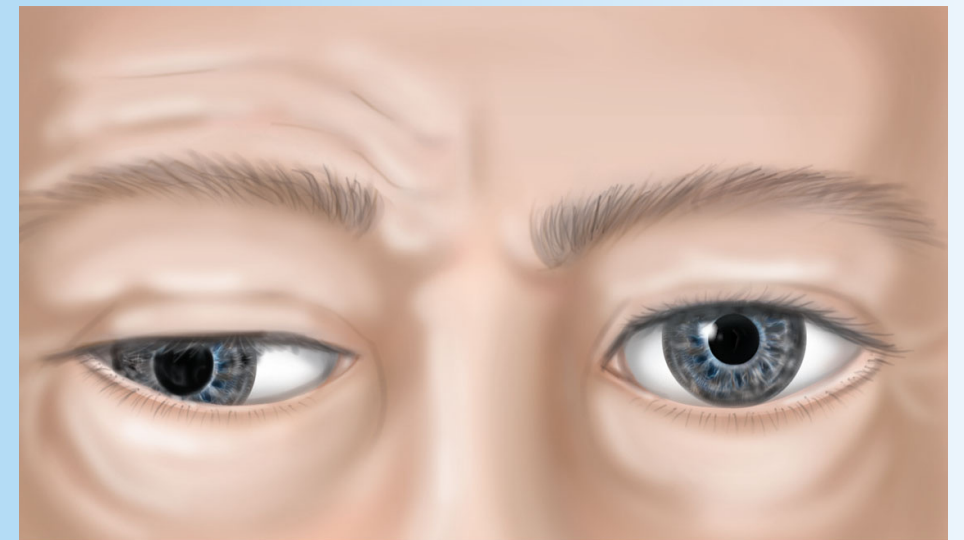
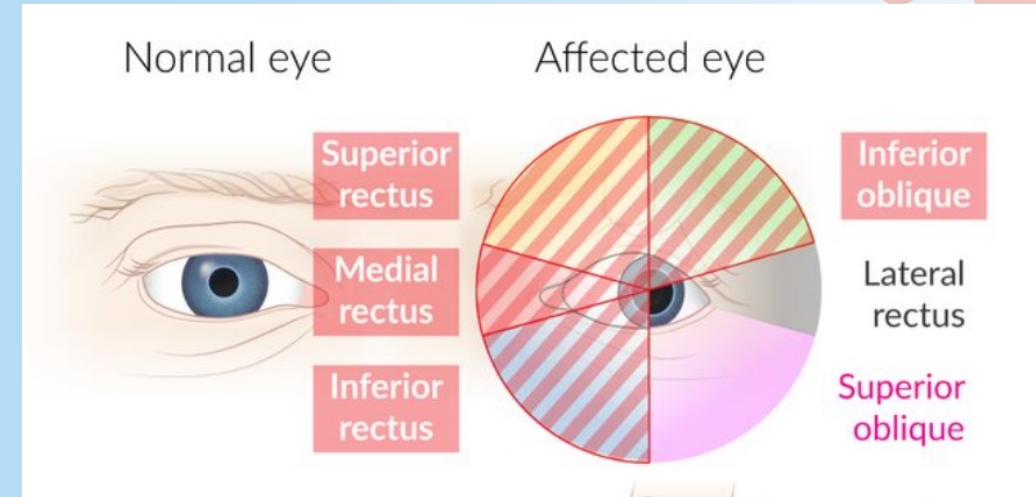
- Sphincter pupillae - responsible for contraction of the pupil
- Ciliary muscles - responsible for accommodation



Lesion of the oculomotor nerve

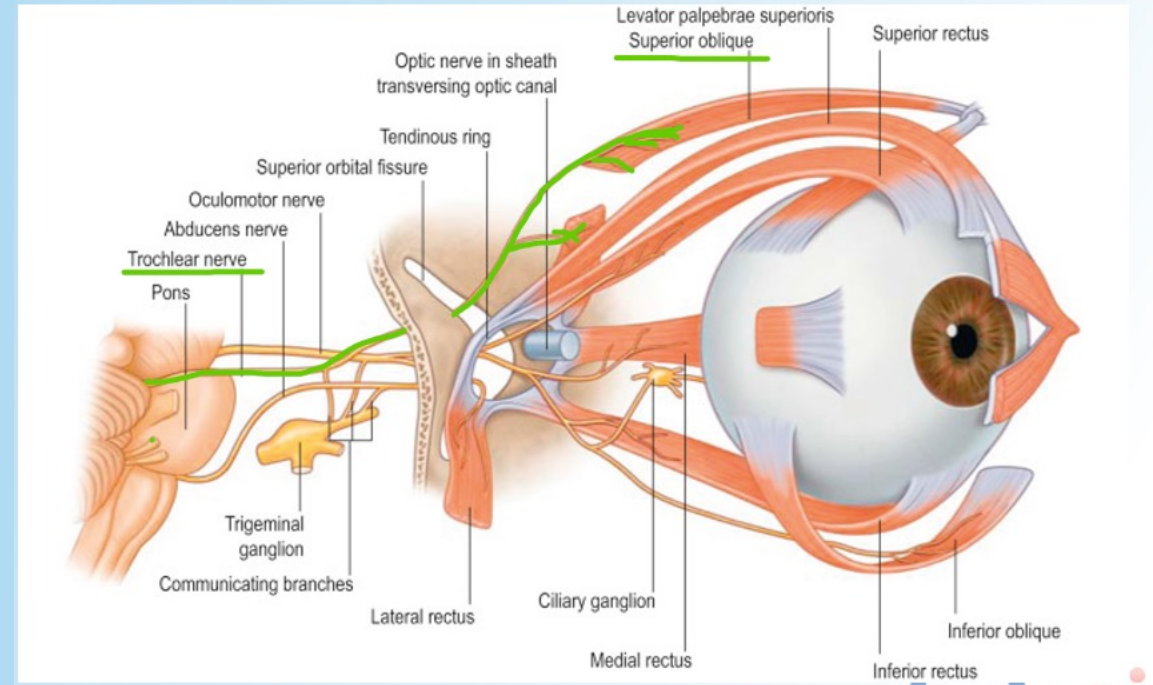
Clinical appearance

- Eye looks down and out
- Ptosis - drooping of the eyelid
- Diplopia
- Cycloplegia (Mydriasis + loss of accommodation)
 - Loss of PS innervation causes fixed and dilated pupil and paralysis of accommodation



CN IV - Trochlear

- Exits skull through Superior Orbital Fissure (SOF) **outside** the common tendinous ring
 - NB! Only CN arising from the posterior side of the brainstem
- **Motor**
- Innervates **Superior Oblique muscle**
 - Responsible for internal (medial) rotation, depression (look down) and abduction of the eyeball



Lesion

- Diplopia when looking down - i.e. when the pt is walking down the stairs
- Pt. typically has a slight head tilt to the opposite side of the lesion

Causes include major head trauma

Cranial nerve palsy	Exam findings – evidence of incomitance		
	Direction of gaze ←	Primary position	Direction of gaze →
Right 4th nerve palsy	 No obvious squint	 Right eye turns upwards and outwards	 Right eye elevates more as it moves medially Double vision further apart

With a lesion of cranial nerve four, you cannot look at the floor.

CN VI - Abducent

- Exits the skull through Superior Orbital Fissure (SOF) and through common tendinous ring.
- **Motor**
- Innervates lateral rectus (LR₆)
 - Meaning it moves the eye laterally

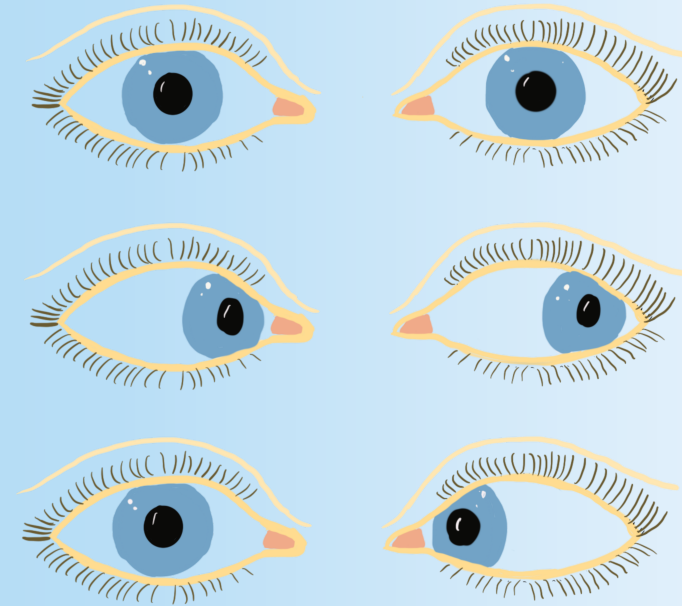
Lesion causes:

- Inability to move the eyeball laterally (abduct)
 - Causes medial deviation of the affected eye due to unopposed action of the medial rectus
- Diplopia - at its worst when looking towards the side of the paralyzed muscle.

Causes include

- Brain tumor
- Thrombosis of the cavernous sinus
 - As XN VI p

Lesion of right abducent nerve



Common tendinous ring

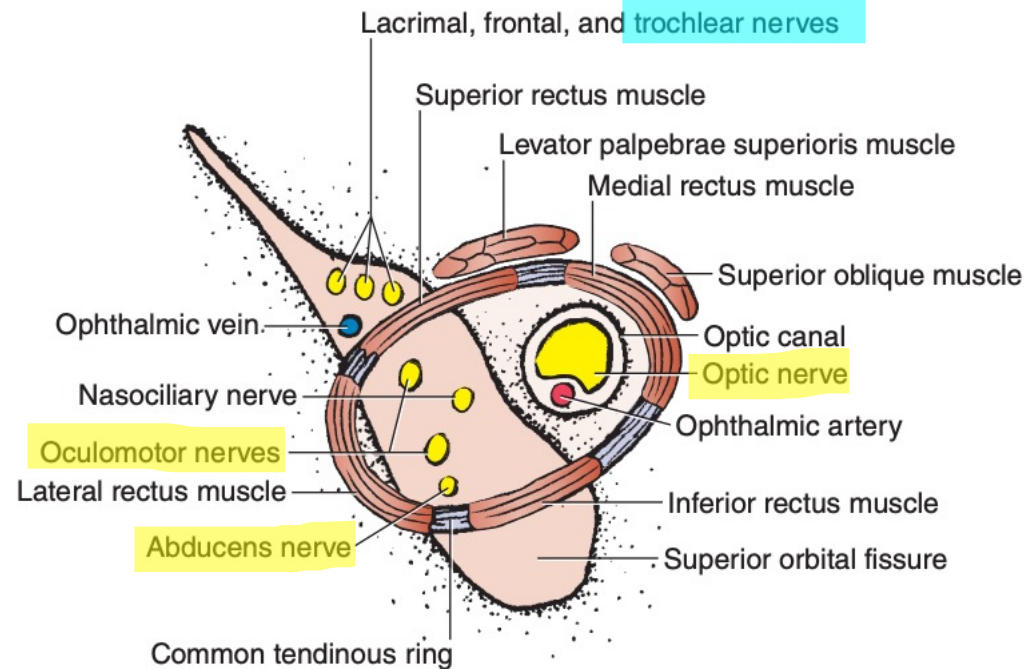


FIGURE 8-39. Common tendinous ring.

- NB!
 - Trochlear nerve is the only one of the nerves going to the muscles of the eye that does not pass through the common tendinous ring.
- Lacrimal, Frontal and nasocilliary nerves are all branches of V1.

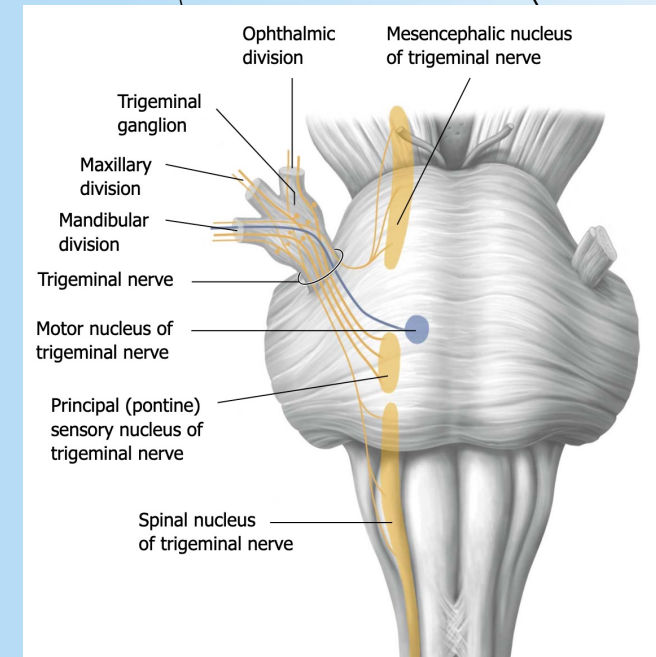
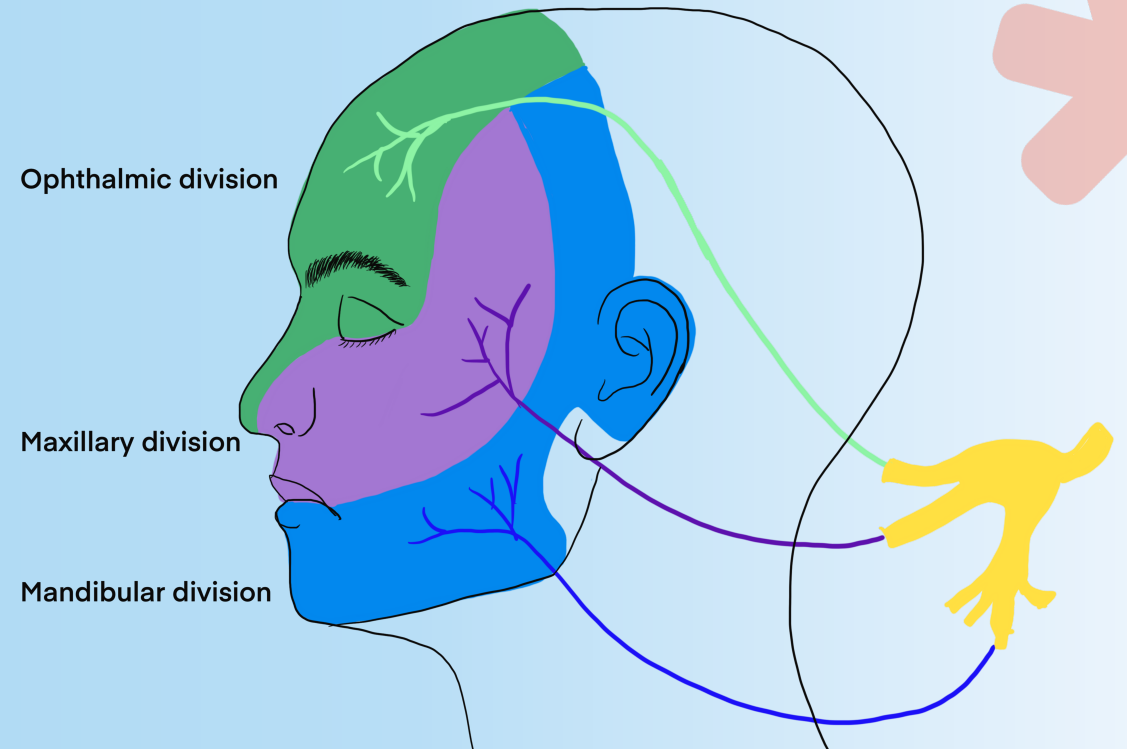
CN V - Trigeminal

- Sensory and Motor
- 3 divisions
 - Ophthalmic (V1)
 - Maxillary (V2)
 - Mandibular (V3)
- Scandale Royale Orgy

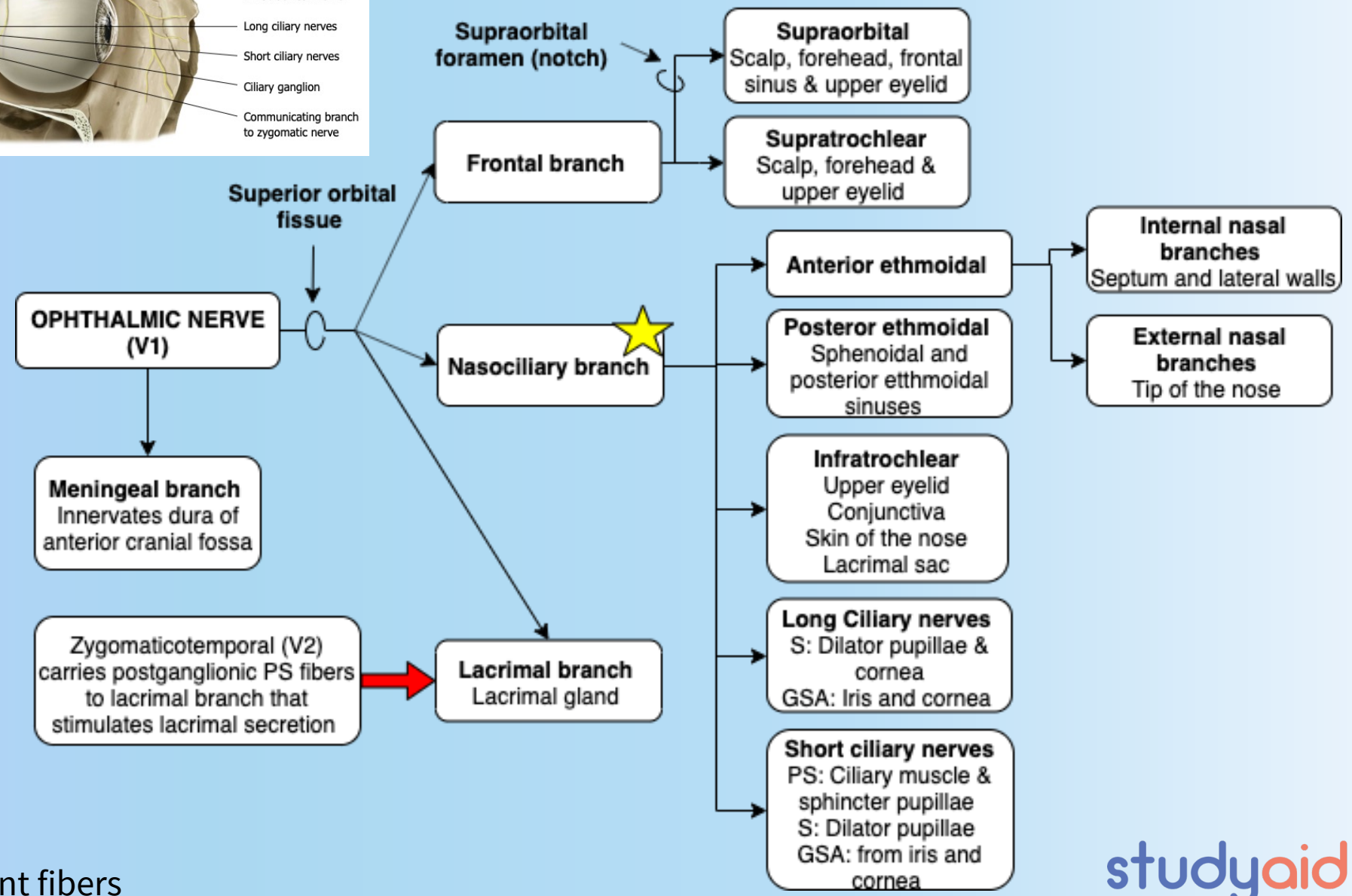
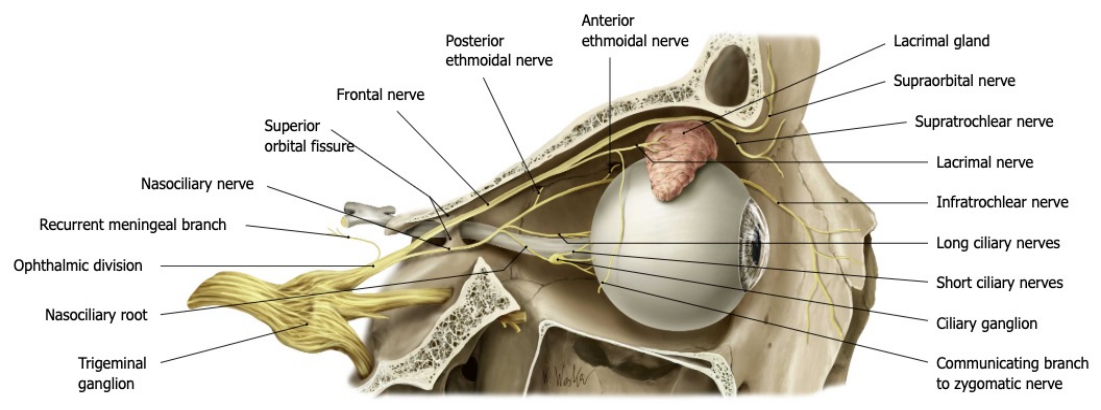
V1 Ophthalmic **S**uperior orbital fissure

V2 Maxillary **R**otundum (foramen rotundum)

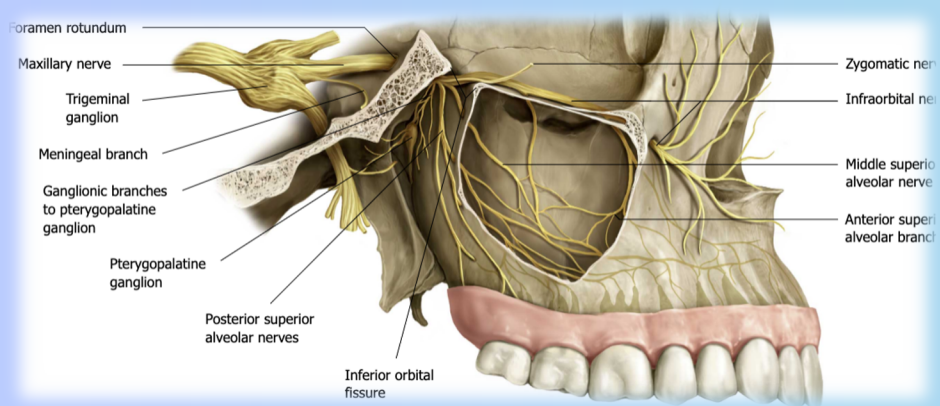
V3 Mandibular **O**vale (foramen ovale)



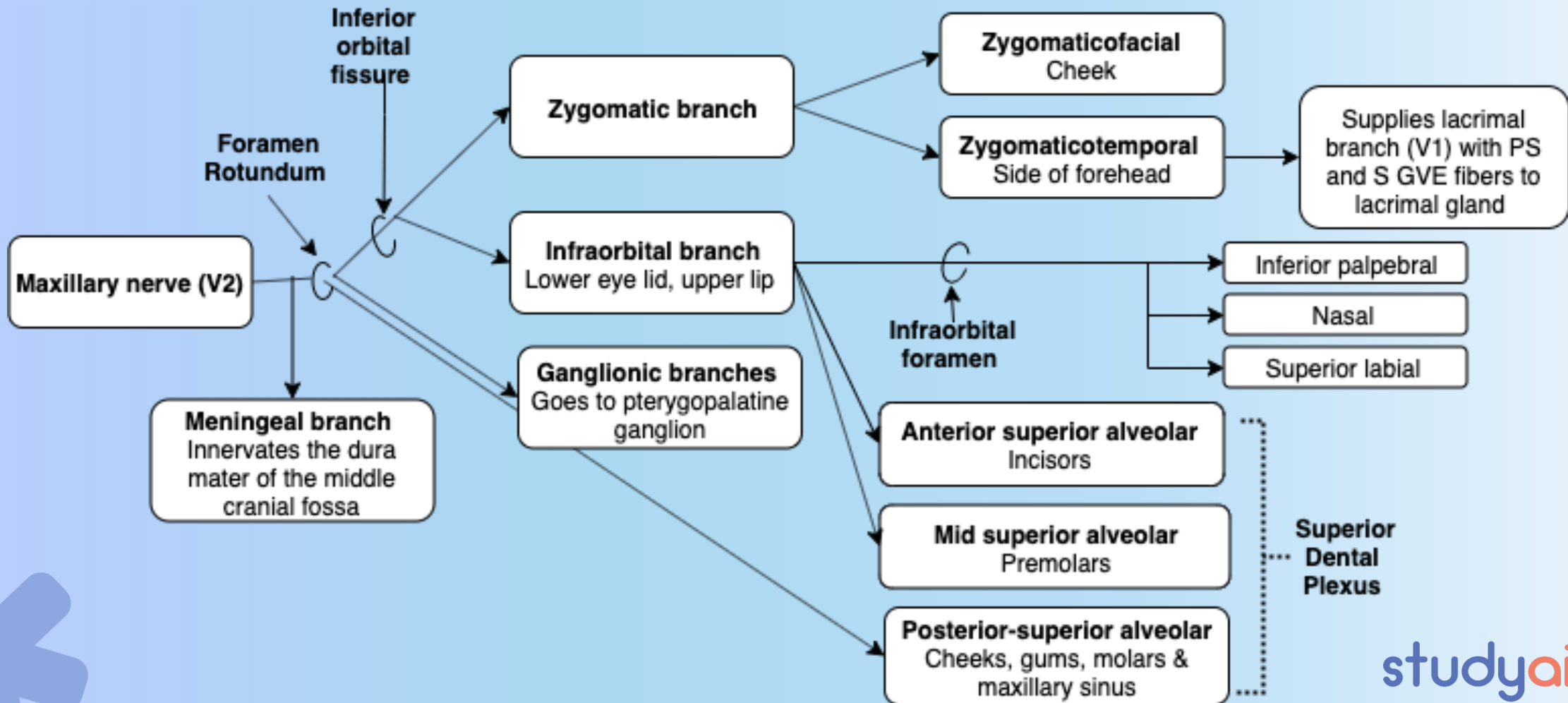
	Ophthalmic (V1)	Maxillary (V2)	Mandibular (V3)
Innervation	<u>Sensory</u> <ul style="list-style-type: none"> • Eyeball • Tip of nose • Skin of face above eyes 	<u>Sensory</u> <ul style="list-style-type: none"> • Skin of the face between the eyes and the upper lip • Palate • Paranasal sinuses • Maxillary teeth 	<u>Sensory</u> <ul style="list-style-type: none"> • Anterior ear • Teeth and gums of mandible • Skin of the face below lower lip • Sensation of 2/3 anterior part of the tongue <u>Motor innervation of</u> <ul style="list-style-type: none"> • Muscles of mastication • Anterior belly of digastric • Mylohyoid • Tensor veli palatini • Tensor tympani
Path « Scandale Royal Orgy »	Runs in the lateral wall of the cavernous sinus Exits through S uperior Orbital foramen	<ul style="list-style-type: none"> • Runs through the lateral wall of the cavernous sinus • Exits through foramen Rotundum and enter the pterygopalatine fossa. 	Exits the skull through foramen O vale
Reflex	Afferent limb of the corneal reflex <ul style="list-style-type: none"> • Nasociliary branch 	Afferent limb of the sneeze reflex	Efferent AND afferent limb of the jaw jerk reflex

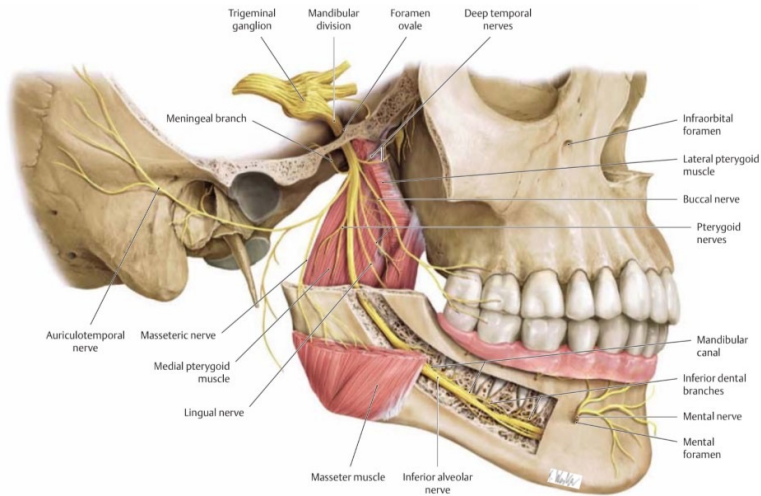


PS: Parasympathetic fibers
S: Sympathetic fibers
GSA: General somatic afferent fibers

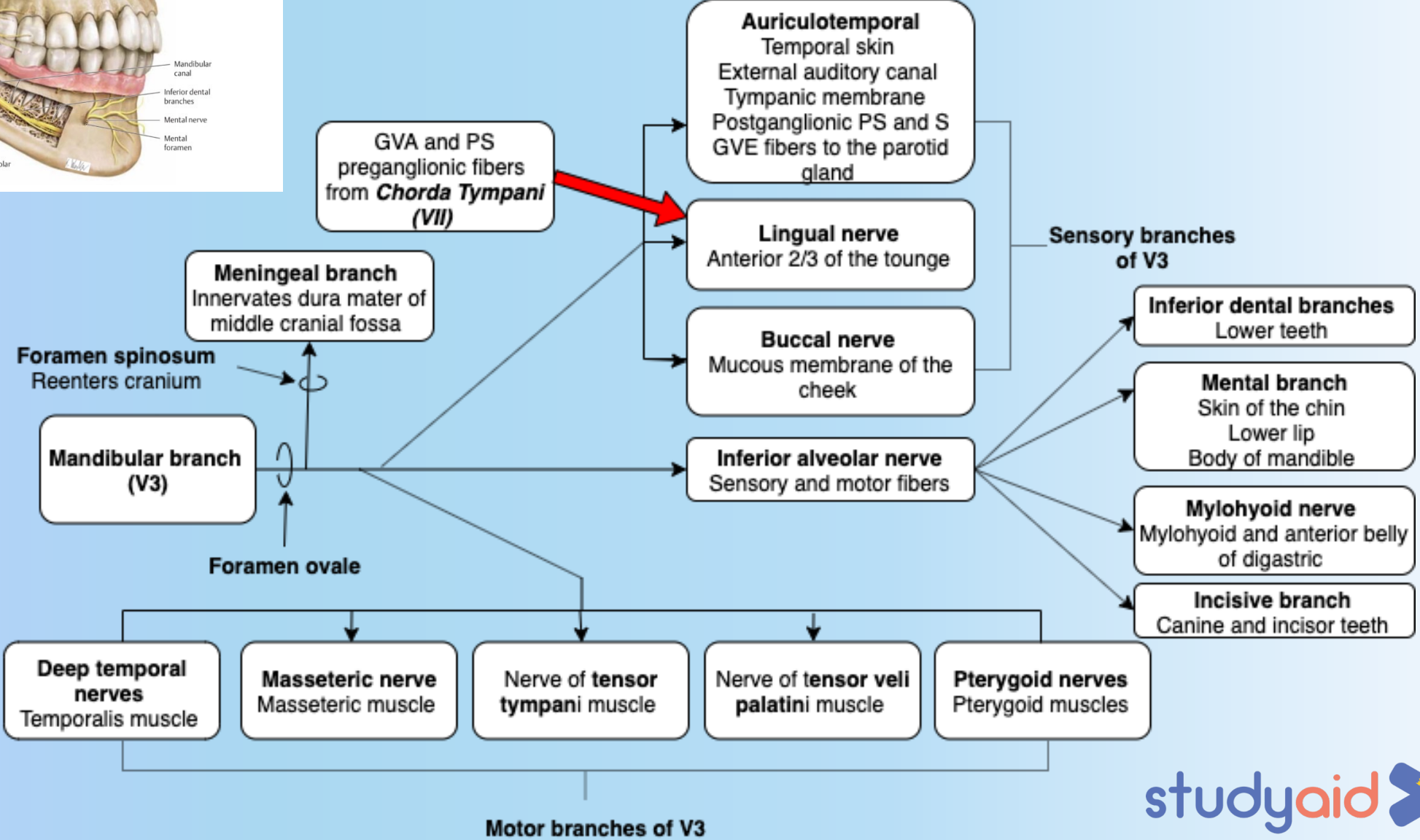


PS: Parasympathetic fibers
S: Sympathetic fibers
GVE: General visceral efferent





M asseter	M oves the mandible UP (Closes the mouth)
M edial Pterygoid	
T emporalis	L ower the mandible (Opens the mouth)
L ateral Pterygoid	



Clinical appearance

- Loss of general sensation from the face and mucous membranes of the oral and nasal cavities.
- Loss of corneal reflex
- Flaccid paralysis of muscles of mastication.
- Deviation of patient's jaw to the weak side
- Paralysis of tensor tympanii = hypacusis
- Innervation of the Dura Mater is both CN V and CN X (+C1).
- Compression will cause headache

Anterior cranial fossa	V1
Middle cranial fossa	V2 & V3
Posterior cranial fossa	CN X and C1 (via XII)

CN VII - Facial nerve

Sensory innervation of the

- TASTE (SVA) - 2/3 anterior part of the tongue
- Palate and nasal mucosa
- External acoustic meatus, auricle.

Motor innervation of

- Muscles of facial expression

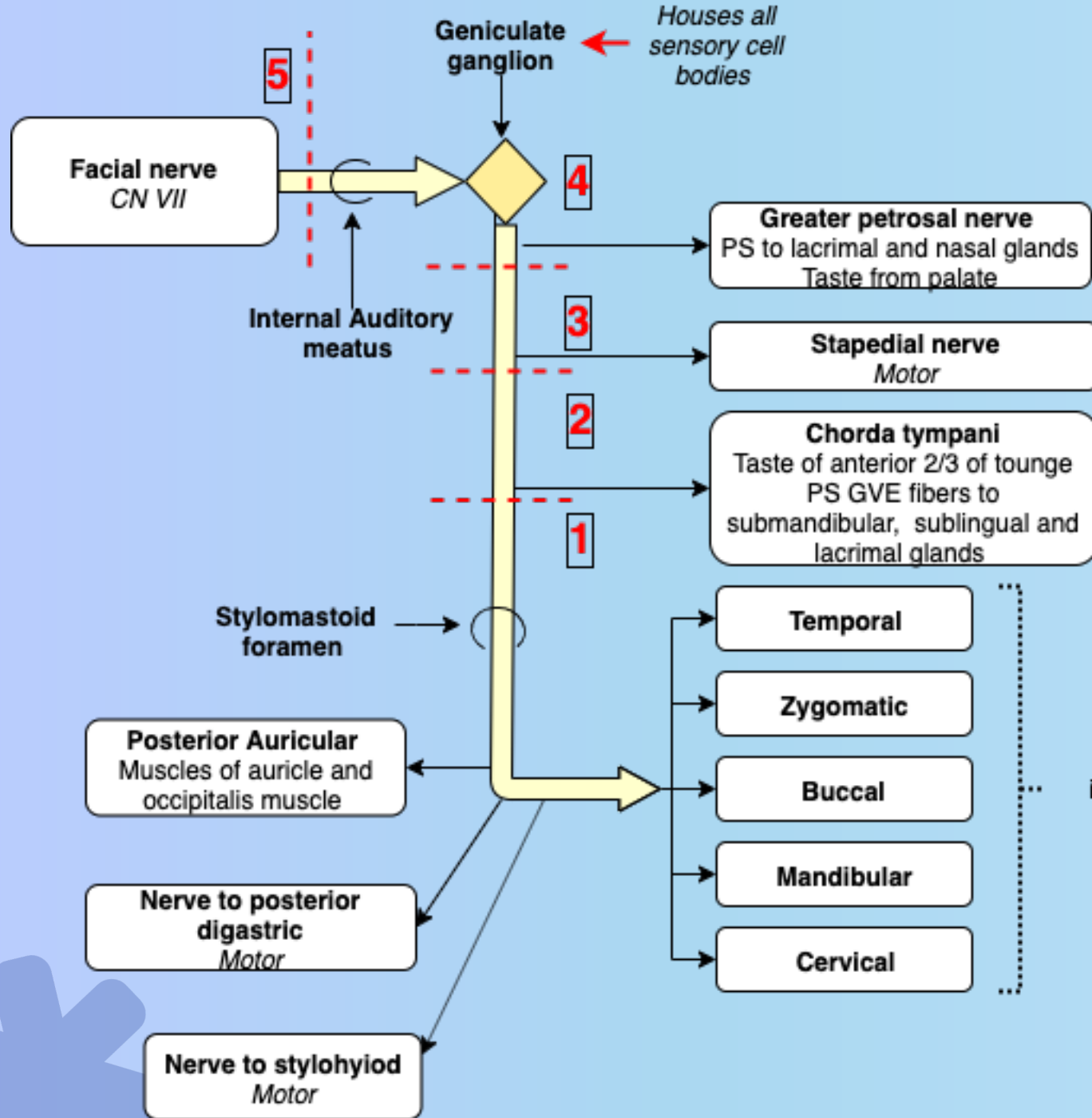
Parasympathetic innervation of

- Lacrimal, submandibular, sublingual, nasal and palatine glands

Reflex

Efferent limb of the corneal (blink) reflex





Pathway goes through internal acoustic meatus, through the facial canal and out through the stylomastoid foramen

NB! Chorda tympani exits the facial canal, goes between malleolus and incus and exits via the petrotympanic fissure

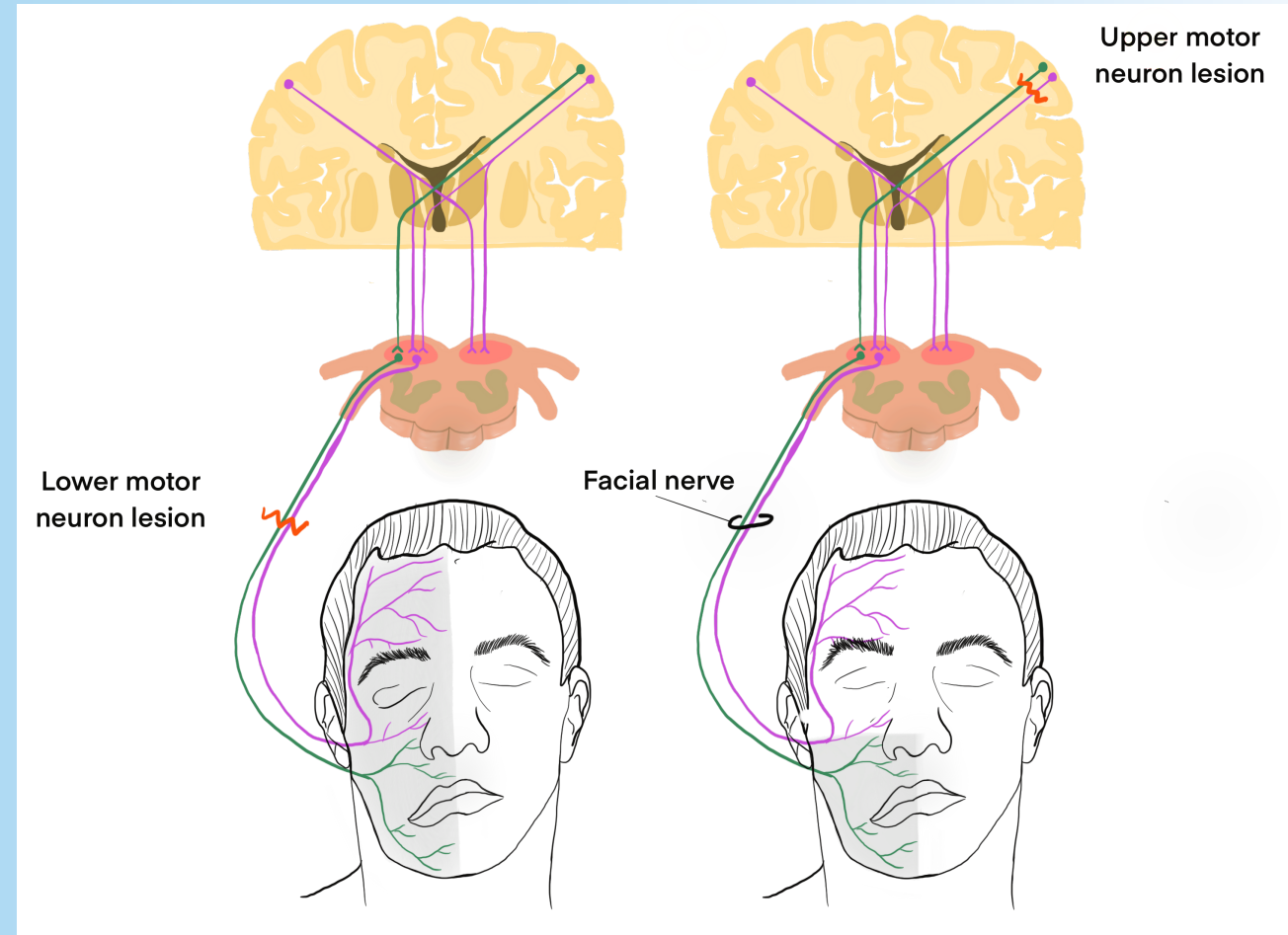
Terminal branches innervating muscles of facial expressions

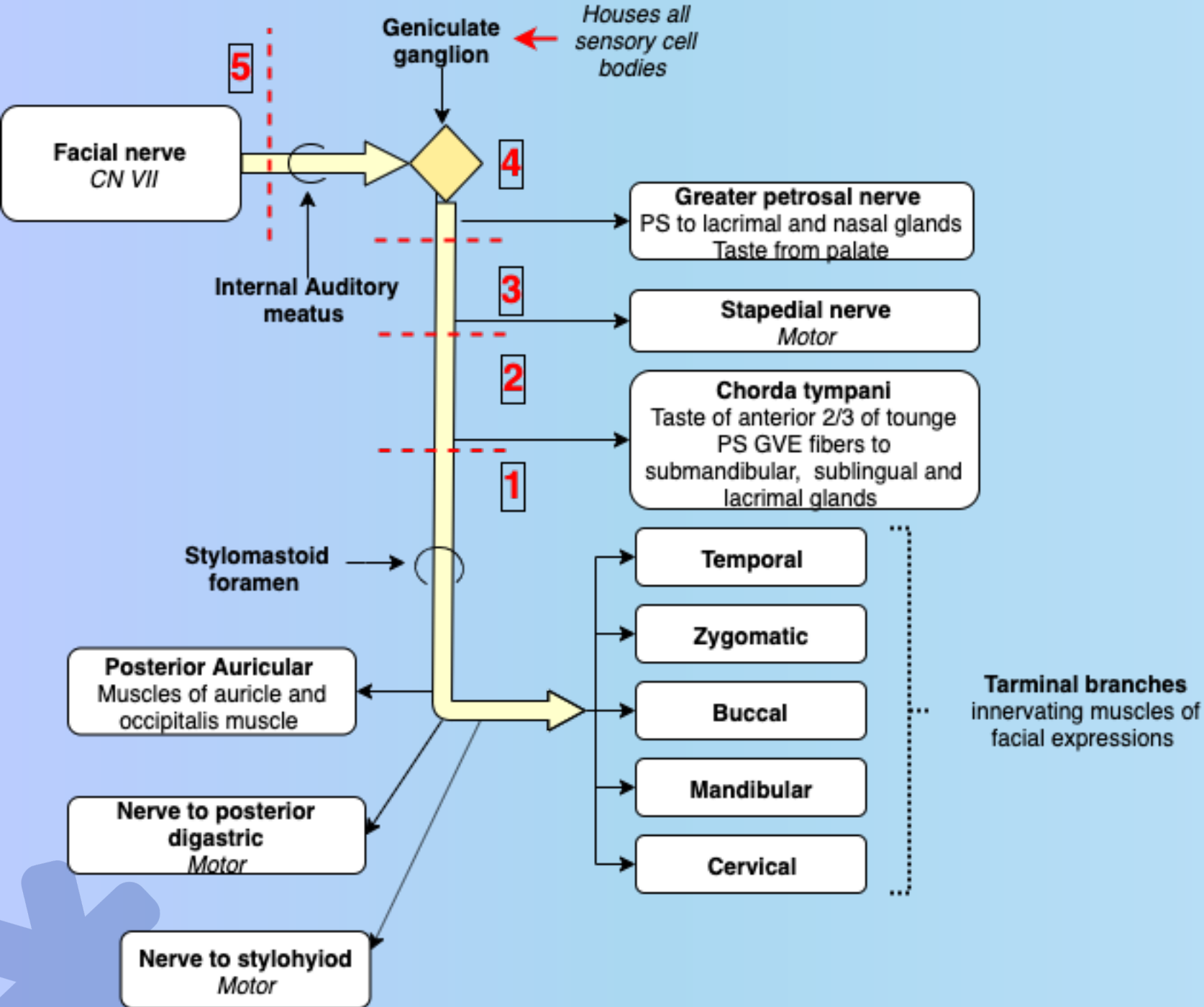
Lesion of the facial nerve

- Loss of function of muscles of facial expression
- Loss of corneal reflex
 - Can cause corneal ulceration

Bell's palsy

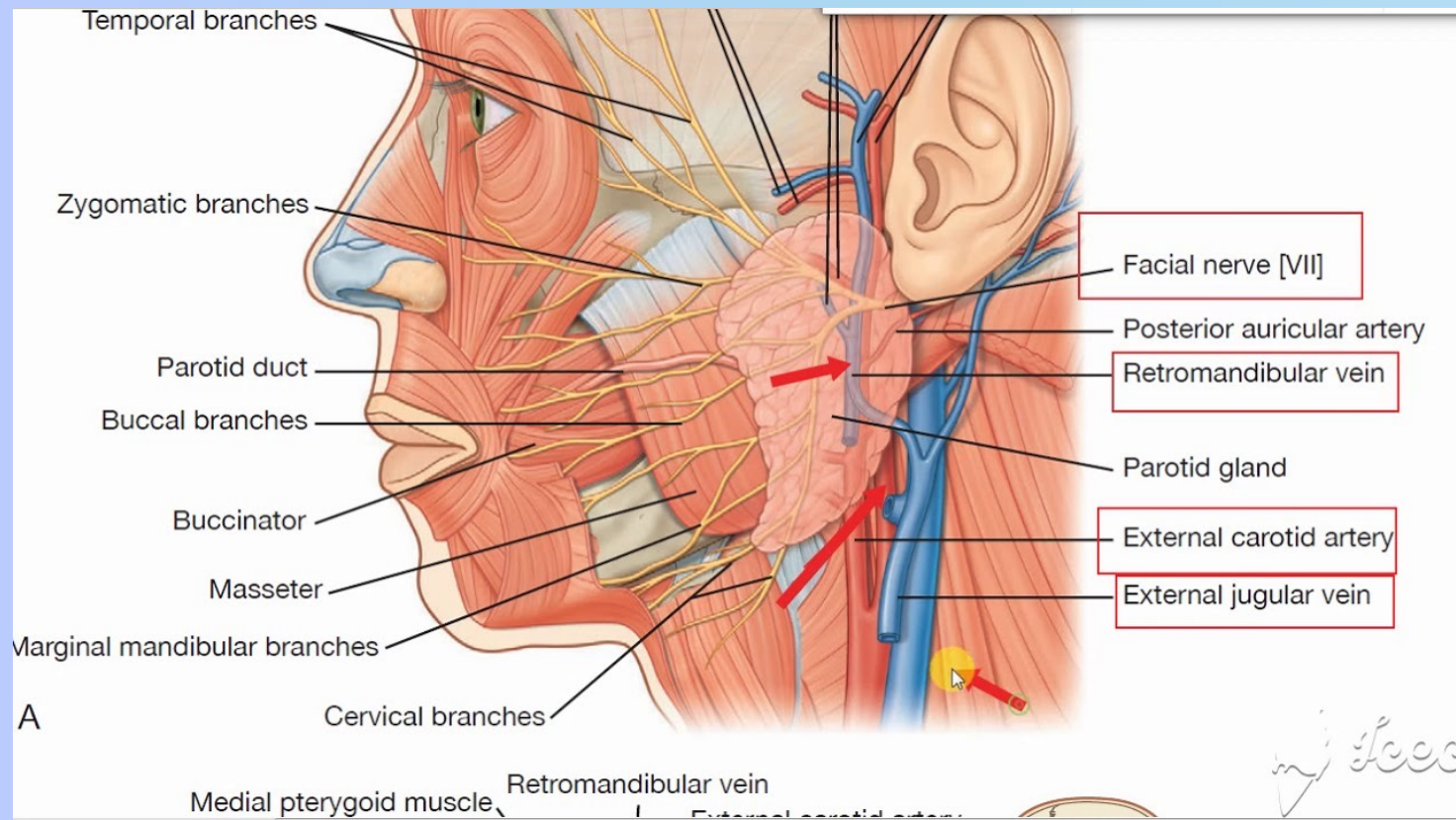
Ipsilateral paralysis of facial muscles, with lesion of peripheral nerve





Consequences of lesion – step by step

- 1 Loss of muscles of facial expression
- 2 Loss of taste in anterior 2/3 of the tongue and disturbances with salivation
- 3 Paralysis of stapedius muscle =hyperacusis
- 4 Problems with lacrimation
- 5 Accompanied by problems with hearing and balance (deafness and dizziness)



CLINICAL CORRELATION

Facial nerve passes through the parotid gland after exiting from the stylomastoid foramen. BUT it does not innervate the parotid gland.

This means that damage to the parotid gland, or a tumor of the parotid can damage the facial nerve. Other structures that can be damaged is highlighted in red.

NB! Posterior Auricular does not enter the parotid gland. Runs immediately behind the auricle.

CN IX- Glossopharyngeal

Exit through the jugular foramen

Sensory

- Taste and sensation of posterior 1/3 part of the tongue
- Somatosensation of pharyngeal wall

Motor

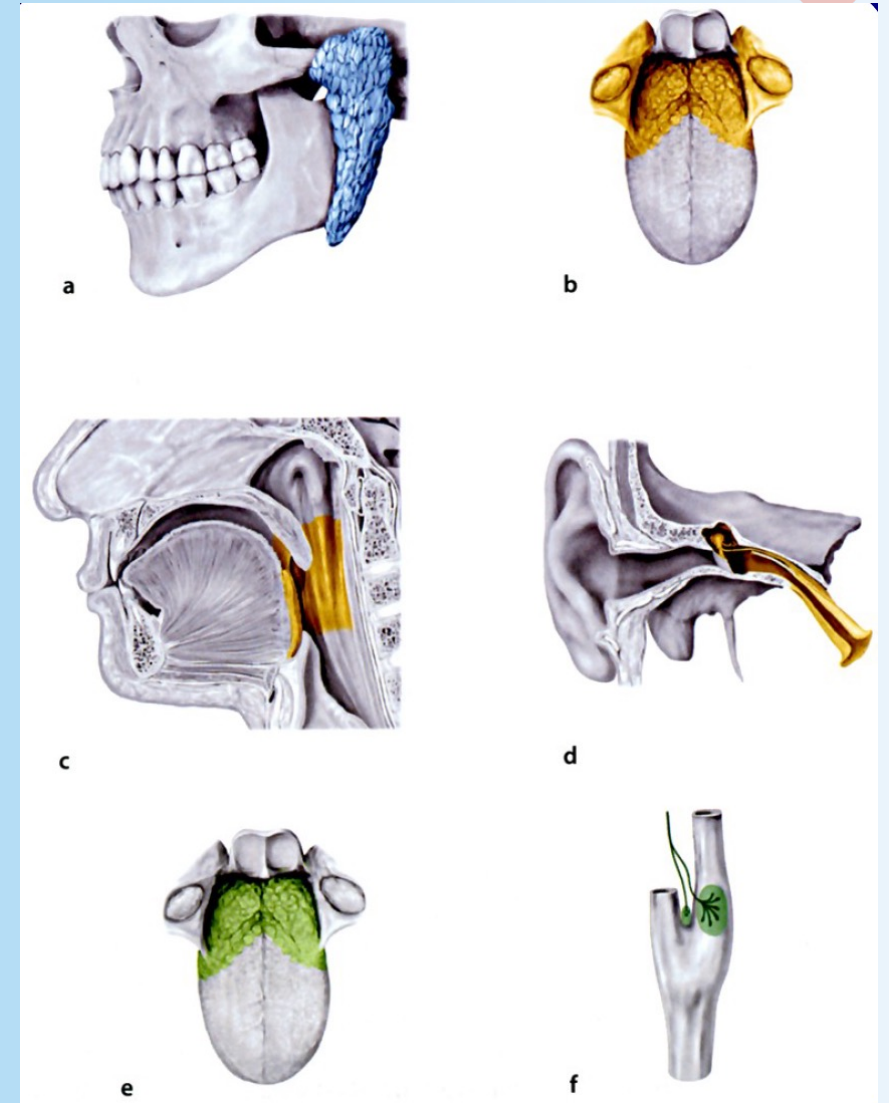
- Innervates stylopharyngus

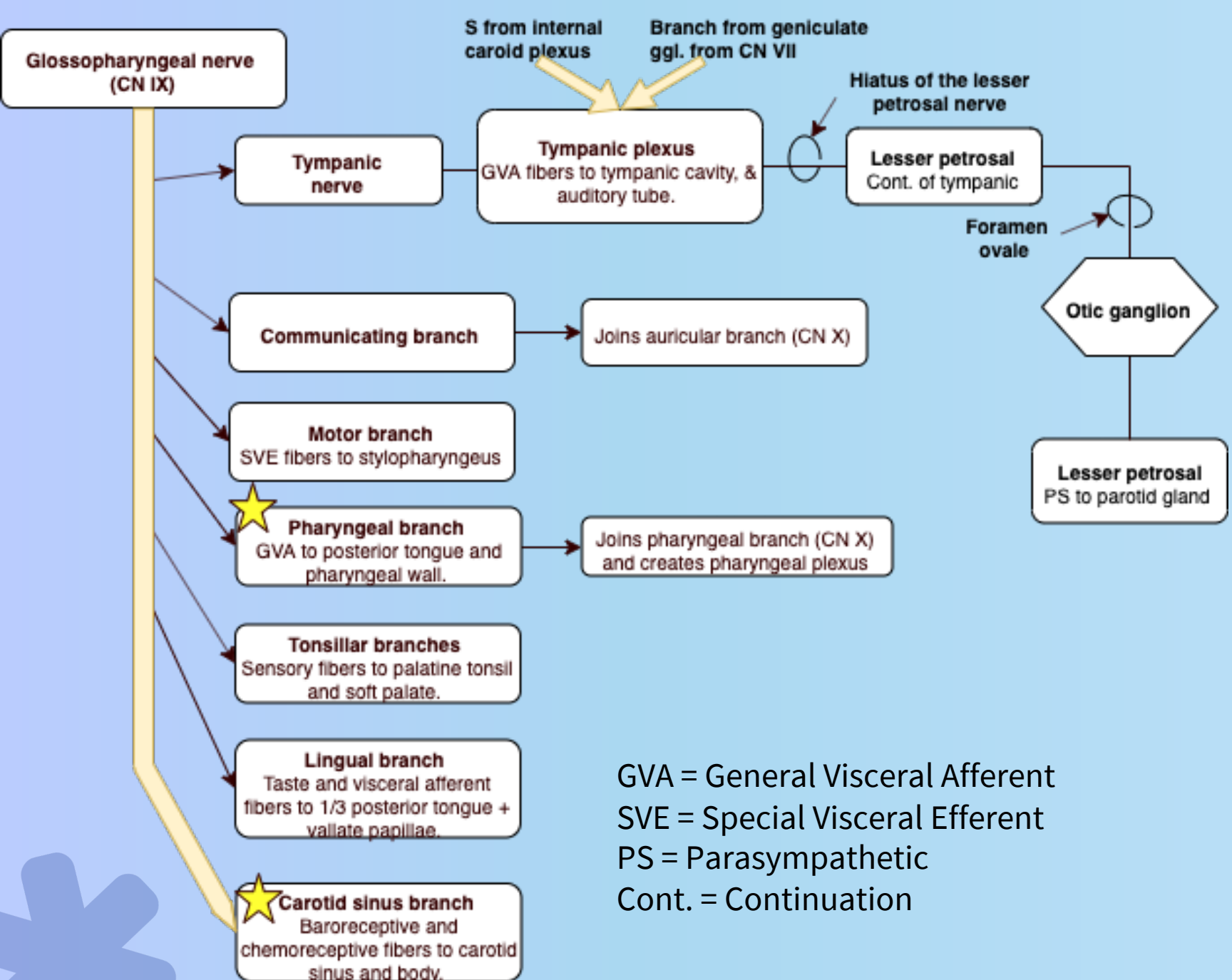
Parasympathetic

- Parotid gland (salivation)

Reflex

- Afferent limb of the gag reflex
- Afferent limb of the carotid sinus reflex





GVA = General Visceral Afferent
 SVE = Special Visceral Efferent
 PS = Parasympathetic
 Cont. = Continuation

Glossopharyngeal

Lesion

- Loss of gag reflex
- Loss of carotid sinus reflex
- Loss of taste from posterior 1/3 of tongue
- Glossopharyngeal neuralgia

CN X - Vagus

Exit the skull through the jugular foramen

Sensory

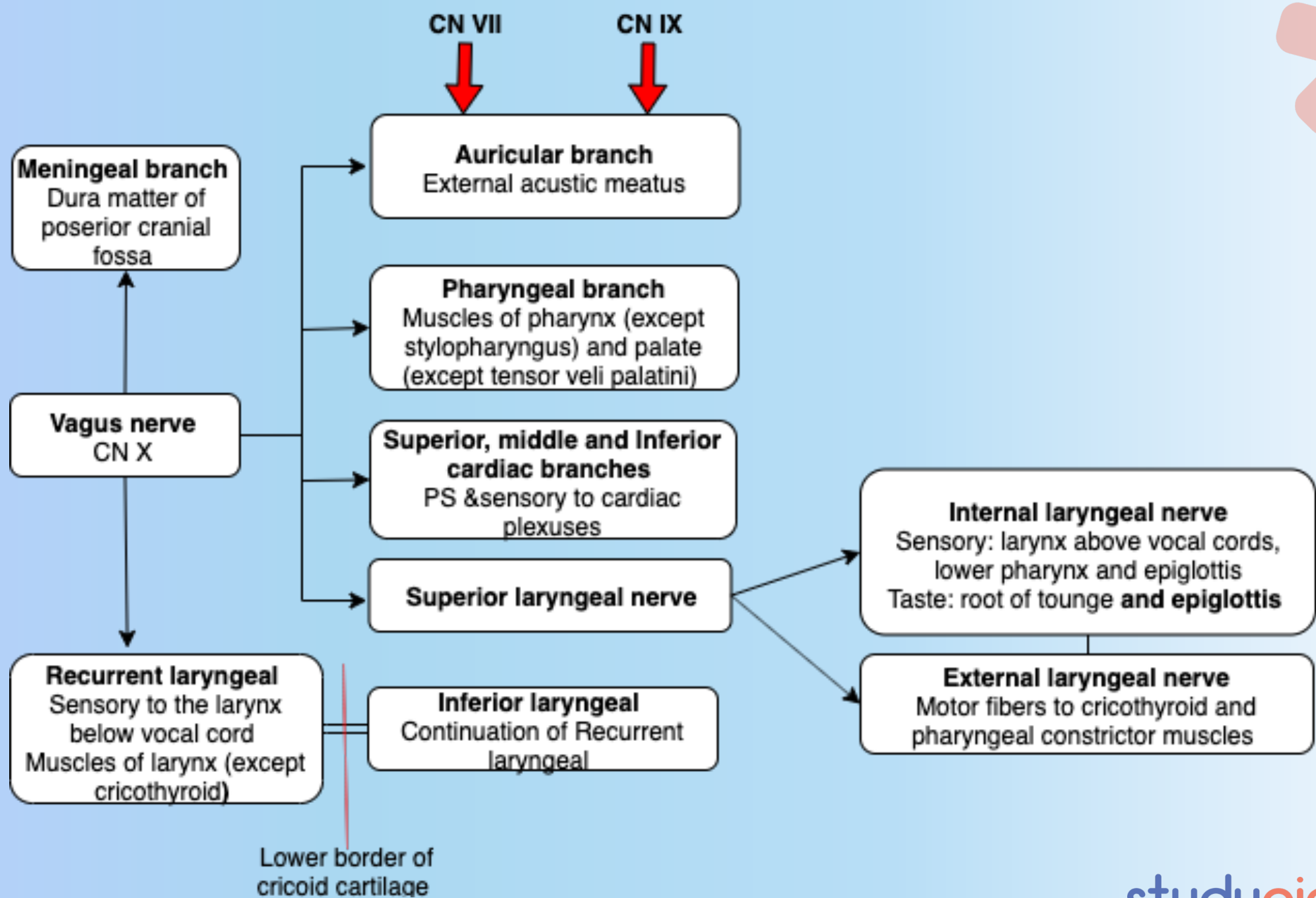
- Mucous membranes of lower pharynx, larynx, trachea
- Taste: supraglottic region
- Visceral sensation from lung, liver, kidneys, stomach, and a large part of the intestines
- **Aortic body: baroreceptors for blood pressure and chemoreceptors for PaO₂ and PaCO₂**

Motor

- Swallowing - most muscles of pharynx (not stylopharyngus) and soft palate (palatoglossus)
- Speech - Larynx through recurrent laryngeal nerve

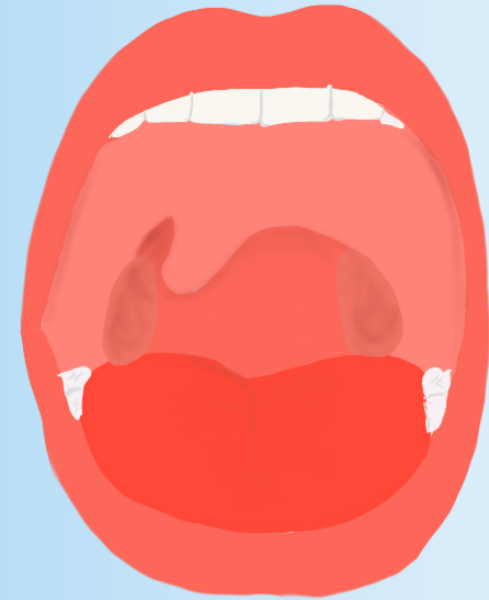
Parasympathetic

- Promotes motility in smooth muscles the esophagus, stomach and most of the intestines
- **Innervates SA and AV node and causes decrease in heart rate** ❤️
- Reflexes
 - Afferent and efferent limb: cough reflex
 - Efferent limb: Sneeze and gag reflex



Clinical features of Vagus lesion in the head and neck

- Loss of reflexes - gag, sneeze and cough
- Ipsilateral paralysis of soft palate, pharynx, larynx causes
 - Slurred speech (Dysarthritia)
 - Difficulty swallowing (Dysphagia)
 - Hoarseness (Dysphonia)
 - Deviation of the uvula
 - Will deviate to the opposite side of the lesion if you make the patient say «Aah»



The exceptions



All muscles of the palate is innervated by vagus (X) EXCEPT

TENSOR VELI PALATINI – Maxillary (V2)

All muscles of the tongue is innervated by hypoglossal (XII) EXCEPT

PALATOGLOSSUS - Vagus (X)

All muscles of the pharynx is innervated by vagus (X) EXCEPT

STYLOPHARYNGUS – Glossopharyngeal (IX)

All muscles of the larynx is innervated by the recurrent laryngeal nerve EXCEPT

CRICOTHYROID – External laryngeal

Reflexes

Reflex	Afferent limb	Efferent limb
Corneal reflex	V1 - Nasociliary branch	Facial nerve ¹ – CN VII
Pupillary light reflex	Optic nerve – CN II	Oculomotor ² – CN III
Accommodation	Optic nerve – CN II	Oculomotor ² – CN III
Lacrimation	Ophthalmic division – CN V1	Facial nerve ¹ – CN VII
Jaw jerk	Mandibular division – CN V3 (Sensory)	Manidbular division – CN V3- (Motor)
Gag reflex	Glossopharyngeal – CN IX	Vagus – CN X
Cough reflex	Vagus – CN X	Vagus – CN X
Sneeze reflex	Maxillary division – CN V2	Vagus – CN X

¹ Orbicularis oculi, innervated by temporal branch of VII, closes the eye

² Parasympathetic fibers from Edinger-Westphal nucleus of CN III